

## OPTIONAL COMPONENTS OF THE CYCLE OF MAJOR COURSES

### *Optional component 1*

**Course: Commercialization of research and development**

*Intensity of the Course:* 5 academic credits

*Module Code:* BM-1

*Module Name:* Basic module

*Prerequisites:* PONI 5205 Planning and organization of scientific research

*Purpose:* Increasing the ability of doctoral students to organize scientific and technical activities and commercialize the results of scientific research.

*Short Description:* The purpose of the discipline is to form knowledge of the methodological foundations for assessing the economic efficiency of projects, scientific implementation and development of business plans based on the results of scientific research. Doctoral students develop innovative strategies of CASE STUDY to create an implementation infrastructure, study the content stages of commercialization, features of project planning, principles and forms of organization of the system covering the full cycle of scientific production and commercialization of scientific products.

*Learning Outcomes in EP (LOP):*

**LO 2** – They apply deep theoretical and practical knowledge in solving research problems and are able to work on modern technical installations to obtain analytical and numerical calculation of various parameters

**LO 3** – Assess problems, approaches and trends reflecting the current state of alternative energy and energy conservation by applying practical skills in calculating various characteristics of alternative energy sources power plants

**LO 4** – They argue their own scientific point of view by demonstrating high intellectual activity in describing and conducting research on the holistic picture of the world, astrophysics and cosmology, biophysics of complex systems

**LO 5** – Develop a methodology for implementing a unified system of commercialization of the results of scientific and applied research and technology transfer from science to the manufacturing sector in order to meet consumer demand and profit taking into account domestic and foreign experience (using the example of their own scientific research);

*Learning Outcomes in Course (LOC):*

LOC 1 – applies the acquired knowledge to increase its commercial potential;

LOC 2 – defines the goals and objectives of the commercialization of scientific research;

LOC 3 – Masters the creation and use of intellectual property objects in the process of commercialization of the results of scientific and pedagogical research.

*Post requisites:* RP Research practice.

### *Optional component 1*

**Course:** Fundamentals of modern biophysics

*Intensity of the Course:* 5 academic credits

*Module Code:* BM-1

*Module Name:* Basic module

*Prerequisites:* CTSE 5206 Computer technologies in science and education

*Purpose:* Formation of a physical and scientific worldview in modern biophysics and medical physics. Formation of students' knowledge and skills of applying fundamental laws, classical and modern theories of physics, as well as skills of conducting physical research as the basis of future professional activity.

*Short Description:* The purpose of the subject is the formation of knowledge on the basics of biophysics, biophysics of complex systems, molecular and cellular biophysics. Doctoral students have the skills of mathematical and computer modeling of complex biological processes and physical methods of studying biological systems at various levels. Analyze and interpret various biological processes from a physical point of view

*Learning Outcomes in EP (LOP):*

- LO 2** – They apply deep theoretical and practical knowledge in solving research problems and are able to work on modern technical installations to obtain analytical and numerical calculation of various parameters
- LO4** – They argue their own scientific point of view by demonstrating high intellectual activity in describing and conducting research on the holistic picture of the world, astrophysics and cosmology, biophysics of complex systems
- LO5** – Develop a methodology for implementing a unified system of commercialization of the results of scientific and applied research and technology transfer from science to the manufacturing sector in order to meet consumer demand and profit taking into account domestic and foreign experience (using the example of their own scientific research);

*Learning Outcomes in Course (LOC):*

LOC 1 – Plans and conducts analytical and numerical calculations, theoretical and experimental tasks, scientific work in the field of theoretical, experimental and applied physics;

LOC 2 – Conducts experiments of varying complexity on test equipment, instruments and installations in the field of physics;

LOC 3 – Formulates the acquired knowledge, skills and abilities in the field of physics in the future professional activity.

*Post requisites:* RP Research practice.

***Optional component 1***

*Course:* Application of the finite element method to the study of mechanical processes

*Intensity of the Course:* 5 academic credits

*Module Code:* BM-1

*Module Name:* Basic module

*Prerequisites:* DMNM 6303 Design and modeling of new materials

*Purpose:* Mastering by undergraduates theoretical and practical skills of quantum chemical computer modeling methods in the description, prediction and improvement of physical, including electronic, energy and perspective, etc. properties of functionally new materials in the framework of research and teaching activities.

*Short Description:* The purpose of the discipline is the formation of basic concepts and techniques for solving differential and integral equations describing various mechanical processes by the finite element method. Doctoral students study methods of finite element stress modeling of the deformed state of structures using rod, plate and bulk finite elements

*Learning Outcomes in EP (LOP):*

**LO 1** - They compose written and oral academic texts using the results of the research works carried out for presentation to a wide scientific audience and publication in rating publications

**LO 2** – They apply deep theoretical and practical knowledge in solving research problems and are able to work on modern technical installations to obtain analytical and numerical calculation of various parameters

**LO5** – Develop a methodology for implementing a unified system of commercialization of the results of scientific and applied research and technology transfer from science to the manufacturing sector in order to meet consumer demand and profit taking into account domestic and foreign experience (using the example of their own scientific research);

**LO6** – Create mathematical and computer models of complex physical phenomena and processes occurring in various mechanical systems, biological environments using the finite element method

*Learning Outcomes in Course (LOC):*

LOC 1 – Demonstrate theoretical and practical knowledge of quantum chemical modeling of electronic, energy and perspective, etc. properties of functionally new materials;

LOC 2 – Ability to analyze theoretical and experimental data, justify your choice of a way to solve a problem in the professional field, taking into account scientific, economic, environmental and other requirements;

LOC 3 Ability to model and apply visualization methods of processes in polyatomic systems using the VASP program, skills of correct interpretation of the results of simulation calculations and computational methods for improving the studied properties of objects.

*Post requisites:* RP Research practice.

### ***Optional component 1***

***Course: Modern astrophysics and cosmology***

*Intensity of the Course:* 5 academic credits

*Module Code:* BM-1

*Module Name:* Basic module

*Prerequisites:* DTE 2208 Digital Technologies in Education

*Purpose:* Has practical skills of analytical and quantitative calculation of various parameters of the world, processing and analysis of observer data.

*Short Description:* The purpose of the subject is to form doctoral students' knowledge about the modern picture and evolution of the Universe, about alternative and modified theories of gravity, about various cosmological models, about the most modern astrophysical and cosmological discoveries and achievements. As a result of mastering the course, doctoral students will acquire practical skills in analytical and numerical calculation of various parameters of the Universe, processing and analysis of observational data.

*Learning Outcomes in EP (LOP):*

**LO4** – They argue their own scientific point of view by demonstrating high intellectual activity in describing and conducting research on the holistic picture of the world, astrophysics and cosmology, biophysics of complex systems

**LO5** – Develop a methodology for implementing a unified system of commercialization of the results of scientific and applied research and technology transfer from science to the manufacturing sector in order to meet consumer demand and profit taking into account domestic and foreign experience (using the example of their own scientific research);

**LO6** – Create mathematical and computer models of complex physical phenomena and processes occurring in various mechanical systems, biological environments using the finite element method

*Learning Outcomes in Course (LOC):*

*LOC 1* – applies the acquired knowledge in his research work;

*LOC 2* – defines the goals and objectives of scientific research;

*LOC 3* – organizes the search for information, data collection; draws up results; works with literature; compiles the results of research work; plans, prepares and conducts presentations.

*Post requisites:* RP Research practice.